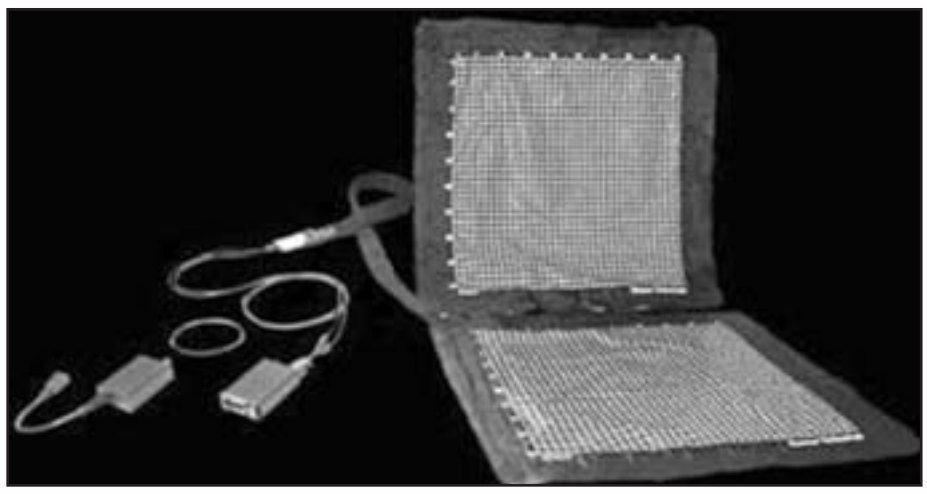
# Comfort, safety goal of ejection seat study



Courtesy of Air Force Research Laboratory

**Researchers at AFRL's Human Effectiveness Directorate completed the second phase of a multi-year seat-cushion study that should help military pilots fly more safely, more alertly and with less fatigue during future long-duration missions. This XSENSOR® pressure mapping system was used to record data from physical pressure points and areas where the subjects' bodies contacted the seat cushion.**

**by John Schutte**
AFRL Human Effectiveness Directorate

Air Force fighter pilots may want to sit down and cheer once their new ejection seats are installed.

New seat cushion designs, based upon data currently being gathered by Air Force Research Laboratory scientists, should make the seats much safer and a little more comfortable over the long haul.

Researchers at AFRL's Human Effectiveness Directorate completed the second phase of a multi-year seat-cushion study that should help military pilots to fly more safely, more alertly and with less fatigue during future long-duration missions.

In collaboration with Wright State University, the scientists and engineers here looked at the physical and mental effects of sitting in an ejection seat for eight hours. The results of their study ultimately should lead to an improved ejection seat design that reduces pilot and crew fatigue, reduces the risk of deep vein thrombosis and helps to prevent discomfort and pain, said Dr. Joseph Pellettiere, the AFRL principal investigator for the study.

Back pain, buttocks and lower-back soreness, tingling and numbness in the legs and overall fatigue are the most common complaints from pilots and crew who fly long-duration missions. Combat bomber crew missions during Operation Enduring Freedom sometimes reached more than 40 hours in length.

"Blood pooling becomes an issue over long-duration missions," said Dr. Pellettiere, whose background includes both mechanical and biomedical engineering. "You're getting less blood to your legs, and this leads to numbness and tingling. You also can start forming localized blood clots that can be released as emboli."

Commercial pilots and passengers can overcome some of these problems by getting up and moving around the cabin, Dr. Pellettiere said. And since commercial aircraft seats do not face the same strict engineering constraints as military ejections seats, they are by design more comfortable than their military counterparts.

But for military pilots, particularly jet fighter pilots tucked into a cocoon-like cockpit, moving around the cabin is not an option; therefore, it is important that military ejection seat cushion materials and designs are selected based on their ability to minimize or eliminate the source of potential problems such as fatigue, blood clots and general discomfort, said Julia Parakkat, government project engineer on the program.

Researchers collected data from 20 test subjects, including Wright State students, civilians and military members. Each test subject sat in each of four ejection seat cushions for eight hours.

Ms. Parakkat said the study combined new test measurements — neck and lower-back muscle fatigue levels and blood oxygen saturation in the legs — with traditional pressure-point measurements and evaluations of mental capabilities.

The new measurements were included because blood-flow issues, particularly blood pooling in the legs, and the associated potential for deep-vein thrombosis and localized back- and shoulder-muscle fatigue are both thought to contribute significantly to discomfort during long flights, she said.

The study was the second phase of an overall effort to develop objective test methods for determining cushion comfort and to develop new state-of-the-art aircrew seat cushion design criteria, Ms. Parakkat said.

In the next phase, which is funded and scheduled to begin in fiscal year 2006, researchers want to use the knowledge they've gained so far to generate design criteria for an ejection-seat cushion that is both safer and more comfortable than existing seats, according to Scott Fleming, who will serve as program manager for the next phase.

"We'll actually flight-test a seat cushion and test it for impact, comfort, vibration and accommodation," Fleming said. Tests will be conducted onboard an F-16 fighter aircraft.

In addition to building a knowledge-base needed for an improved seat design, this project has enabled AFRL to expose local college students to real-world problems and the methods used to solve those problems, Ms. Parakkat said, who also served as the primary point of contact for the professors and students from WSU who participated in the project.

The testing was conducted at Wright State facilities under the guidance of Dr. David Reynolds, the WSU principal investigator for the program.

As in previous studies, researchers used an XSENSOR® pressure mapping system to record data from physical pressure points and areas where the subjects' bodies contacted the seat cushion.

Subjects were also tested for mental processes, such as memory, arithmetic tasks, vision and hearing, and they completed subjective surveys to record discomfort levels and their impression of the seat cushion being tested.

Analysis of the data helped researchers to select the best properties for future seat cushions, based on their ability to prevent deep vein thrombosis and to minimize discomfort over a long period of time.

# AFIT volunteers help with hurricane relief efforts

**by Kim Curry**
AFIT Public Affairs

Shortly after the Hurricane Katrina disaster, Lt. Col. Andrew Schlachter, director of Air Command and Staff College Curriculum at the Air Force Institute of Technology, began inquiring as to how AFIT could help with recovery efforts.

Intermediate Developmental Education students at AFIT were about to take final exams, but would have a two- to three-week break, and many were ready to lend a hand.

Maj. Robin Gibson, an IDE student, put together a meeting for AFIT students, faculty and staff to discuss avenues for helping Katrina victims. Maj. Lynne Bayley volunteered to coordinate with the Dayton Area Red Cross to see what help they needed.

"I met with Janet Kemp of the Dayton chapter, who said she was in desperate need of volunteers to do local area work as well as deploy nationwide, but anyone wishing to help would have to attend a series of seminars." Maj. Bayley said. "I was able to convince her to put three areas — shelter management, case work and disaster relief — together into one day of training, provided I could bring in a minimum of 70 volunteers. I sent out an e-mail AFIT-wide, and within two hours had more than 75 folks volunteer to attend an entire day of training at the Red Cross in Dayton."

After the training, a few IDE students — Maj. Reginald Ash, Maj. Robin Gibson and Maj. Reyes Colon — focused their volunteer efforts on case work.

"As a case worker, I sit down with evacuated families, talk to them and complete the Red Cross paperwork to help the 'clients' receive whatever assistance the Red Cross can provide," Maj. Ash said. "That assistance ranges from cash to hotel rooms to referrals for jobs, as well as clothes, housing, and medical care. We also provide phone numbers to help them contact (the Federal Emergency Management Agency), their home state unemployment offices, and Ohio offices that will issue an ID. Occasionally, if the client doesn't know the whereabouts of family or friends, we help them use the FEMA and Red Cross on-line locator. All clients are seen by a mental health counselor, and they also see nurses if they have medical needs."

Another call for volunteers went out when the Red Cross discovered the information regarding each client wasn't available nationwide,

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